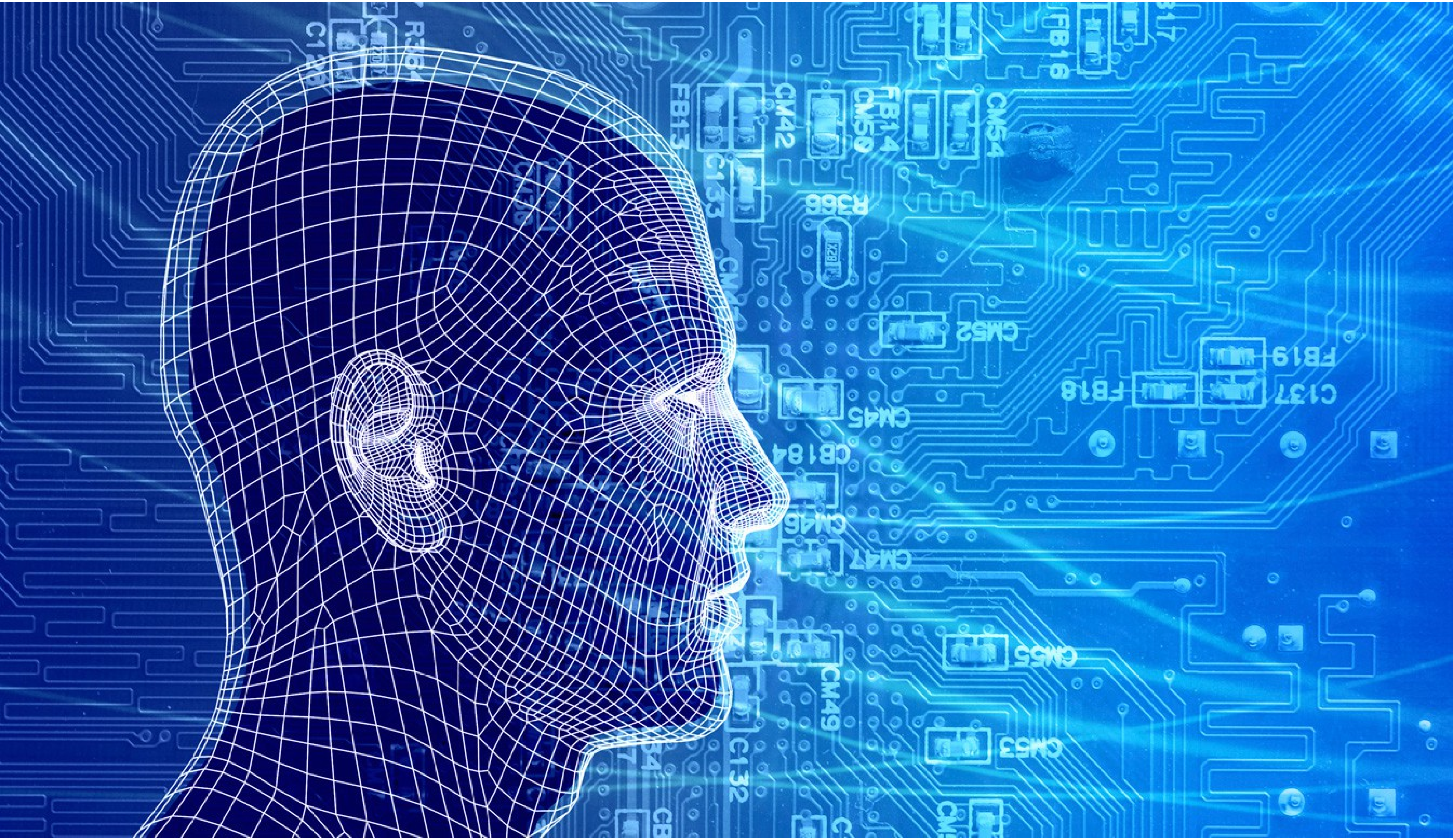
Can machines think like human beings and beyond!

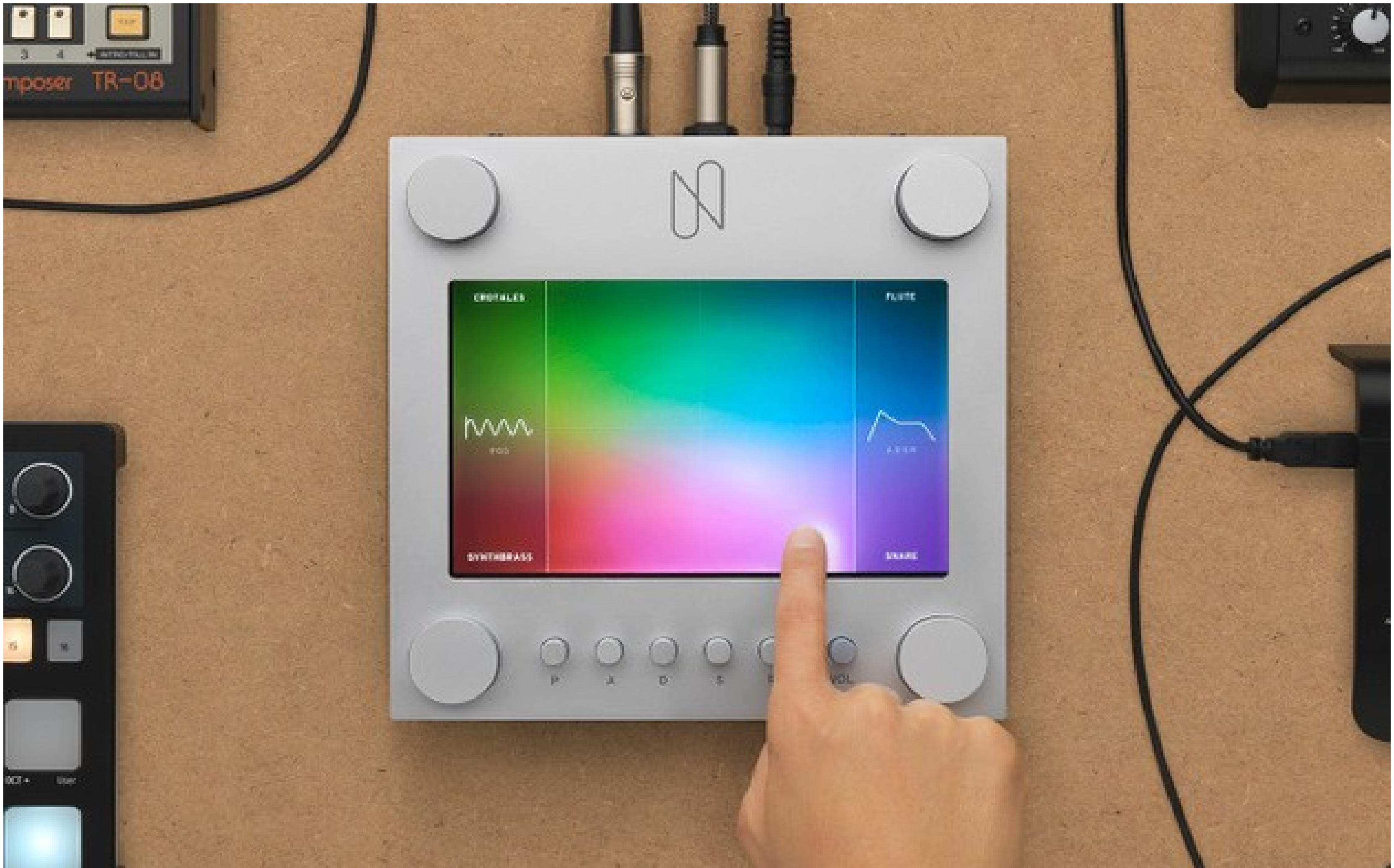


From the days of ENIAC to today. Progress has been tremendous!

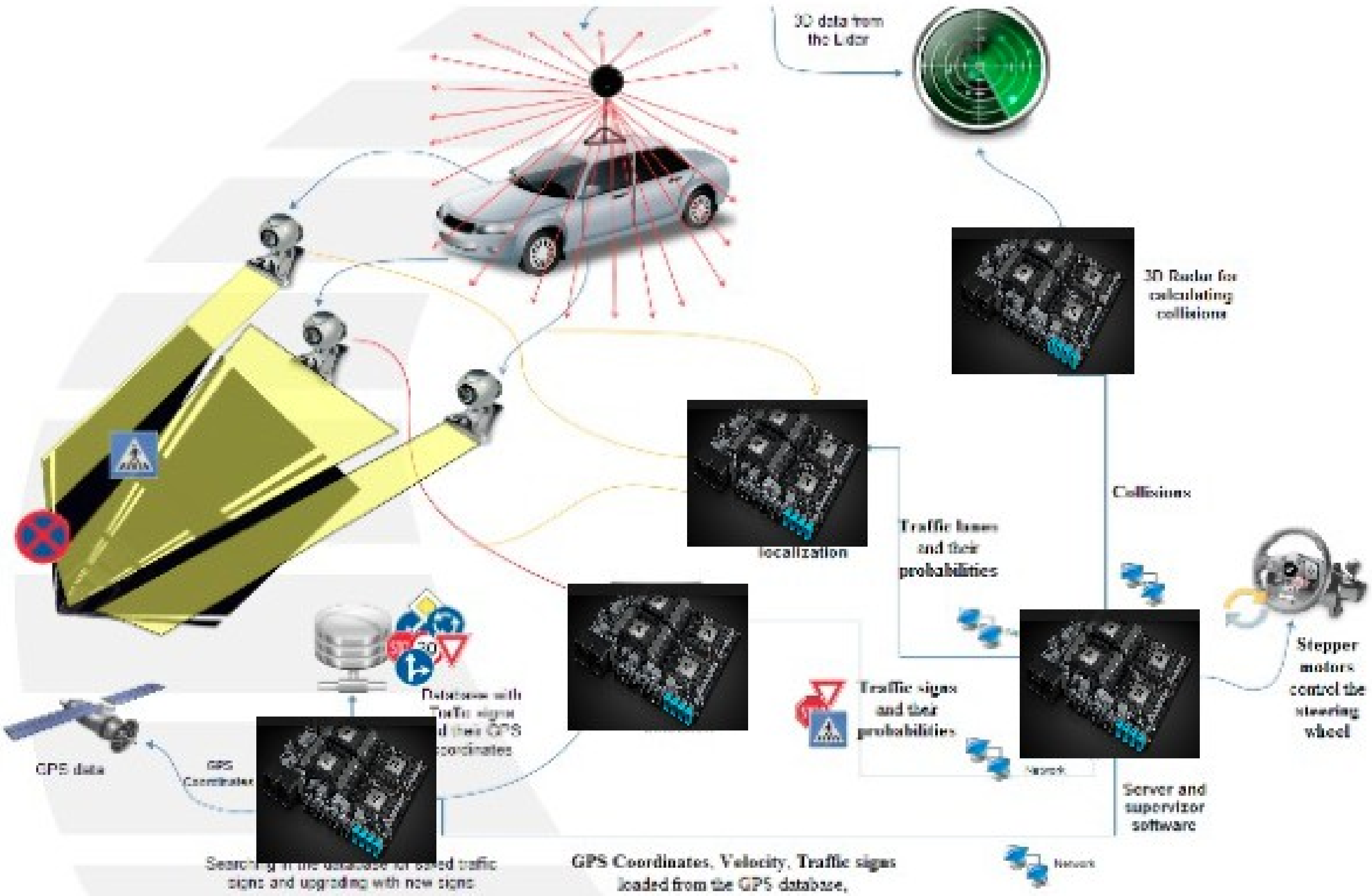
Where is AI...how is AI progressing

Lets See AI in pictures!

Nsynth Super: NN creates new music!



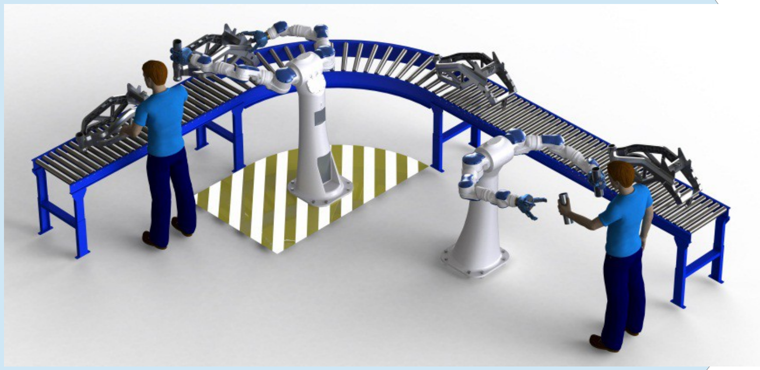
Simplified view of Autonomous car system



Continental AG's SMART Factory

- Active RFID tags and Geo-location are used to move the tire components throughout the factory

- Collaborative robots
  - Robots are "shown" how to do a task once and then they can repeat that action
  - Reduces risks of injuries and reduces the need for additional assisting employees




SNIPER
GENERAL ATOMICS, MQ-9 REAPER


AMAZON ECHO: YOUR BUTLER
IS JEFF BEZOS A NICE GUY?
ORDER AN UBER TO LEAVE IN HALF AN HOUR
IS ARSENAL WINNING THE LEAGUE?
GET ME A MARGHARITA FROM DOMINO'S
SHOULD I WATCH LA-LA LAND?
WHAT'S THE WEATHER ON MONDAY IN HULL?
PLAY MY FAVOURITE MILES TUNE
SET A REMINDER IN 90 MINUTES...
amazon

The Dartmouth Conference and the Name Artificial Intelligence

J. McCarthy, M. L. Minsky, N. Rochester, and C.E. Shannon. August 31, 1955. "We propose that a 2 month, 10 man study of artificial intelligence be carried out during the summer of 1956 at Dartmouth College in Hanover, New Hampshire. The study is to proceed on the basis of the conjecture that every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it."

And , AI was born!

The Origins of AI Hype

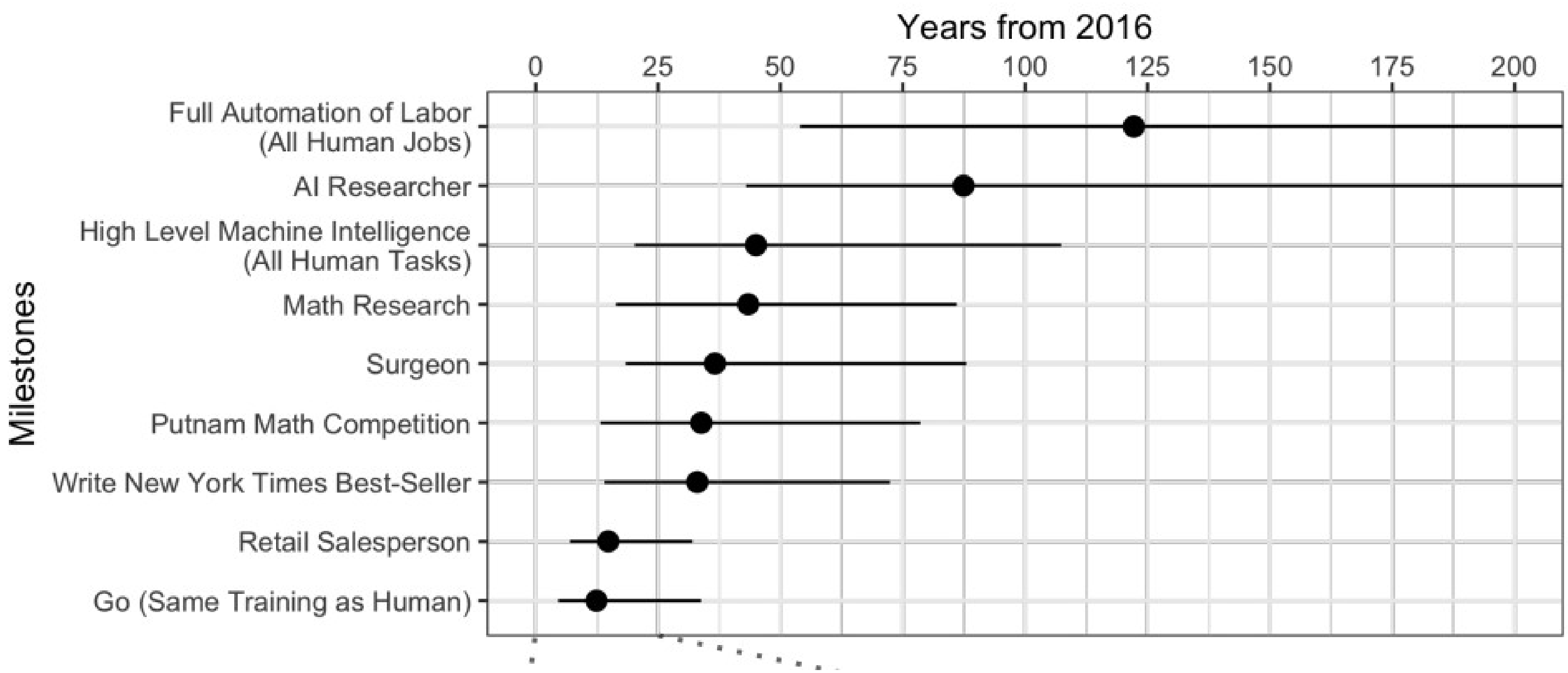
1950 Turing predicted that in about fifty years "an average interrogator will not have more than a 70 percent chance of making the right identification after five minutes of questioning".

1957 Newell and Simon predicted that "Within ten years a computer will be the world's chess champion, unless the rules bar it from competition."

AI History

1943	McCulloch & Pitts: Boolean circuit model of brain
1950	Turing's "Computing Machinery and Intelligence"
1952–69	Look, Ma, no hands!
1950s	Early AI programs, including Samuel's checkers program, Newell & Simon's Logic Theorist, Gelernter's Geometry Engine
1956	Dartmouth meeting: "Artificial Intelligence" adopted
1965	Robinson's complete algorithm for logical reasoning
1966–74	AI discovers computational complexity Neural network research almost disappears
1969–79	Early development of knowledge-based systems
1980–88	Expert systems industry booms
1988–93	Expert systems industry busts: "AI Winter"
1985–95	Neural networks return to popularity
1988–	Resurgence of probabilistic and decision-theoretic methods Rapid increase in technical depth of mainstream AI "Nouvelle AI": ALife, GAs, soft computing

Will Intelligent machines surpass human beings



Will Intelligent machines surpass human beings

Ellon Musk says ““Robots will do everything better than us“

"There certainly will be job disruption. Because what's going to happen is robots will be able to do everything better than us. ... I mean all of us," saidÂ
Musk, speaking to the National Governors AssociationÂ in July. "Yeah, I am not sure exactly what to do about this. This is really the scariest problem to me, I will tell you."

What is AI? (Cont'd)

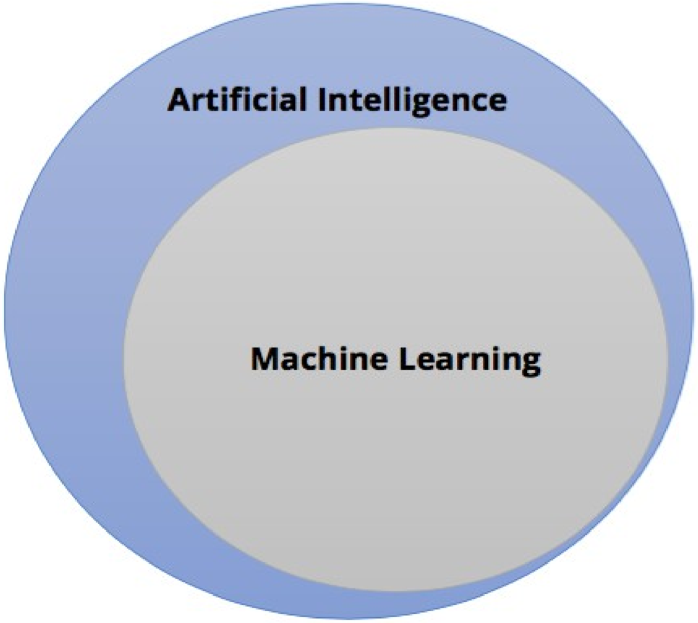
"The exciting new effort to make computers think ... *machines with minds*, in the full and literal sense" (Haugeland, 1985) "[The automation of] activities that we associate with human thinking, activities such as decision-making, problem solving, learning ..." (Bellman, 1978)	"The study of mental faculties through the use of computational models" (Charniak and McDermott, 1985) "The study of the computations that make it possible to perceive, reason, and act" (Winston, 1992)
"The art of creating machines that perform functions that require intelligence when performed by people" (Kurzweil, 1990) "The study of how to make computers do things at which, at the moment, people are better" (Rich and Knight, 1991)	"A field of study that seeks to explain and emulate intelligent behavior in terms of computational processes" (Schalkoff, 1990) "The branch of computer science that is concerned with the automation of intelligent behavior" (Luger and Stubblefield, 1993)

Figure 1.1 Some definitions of AI. They are organized into four categories:

Systems that think like humans.	Systems that think rationally.
Systems that act like humans.	Systems that act rationally.

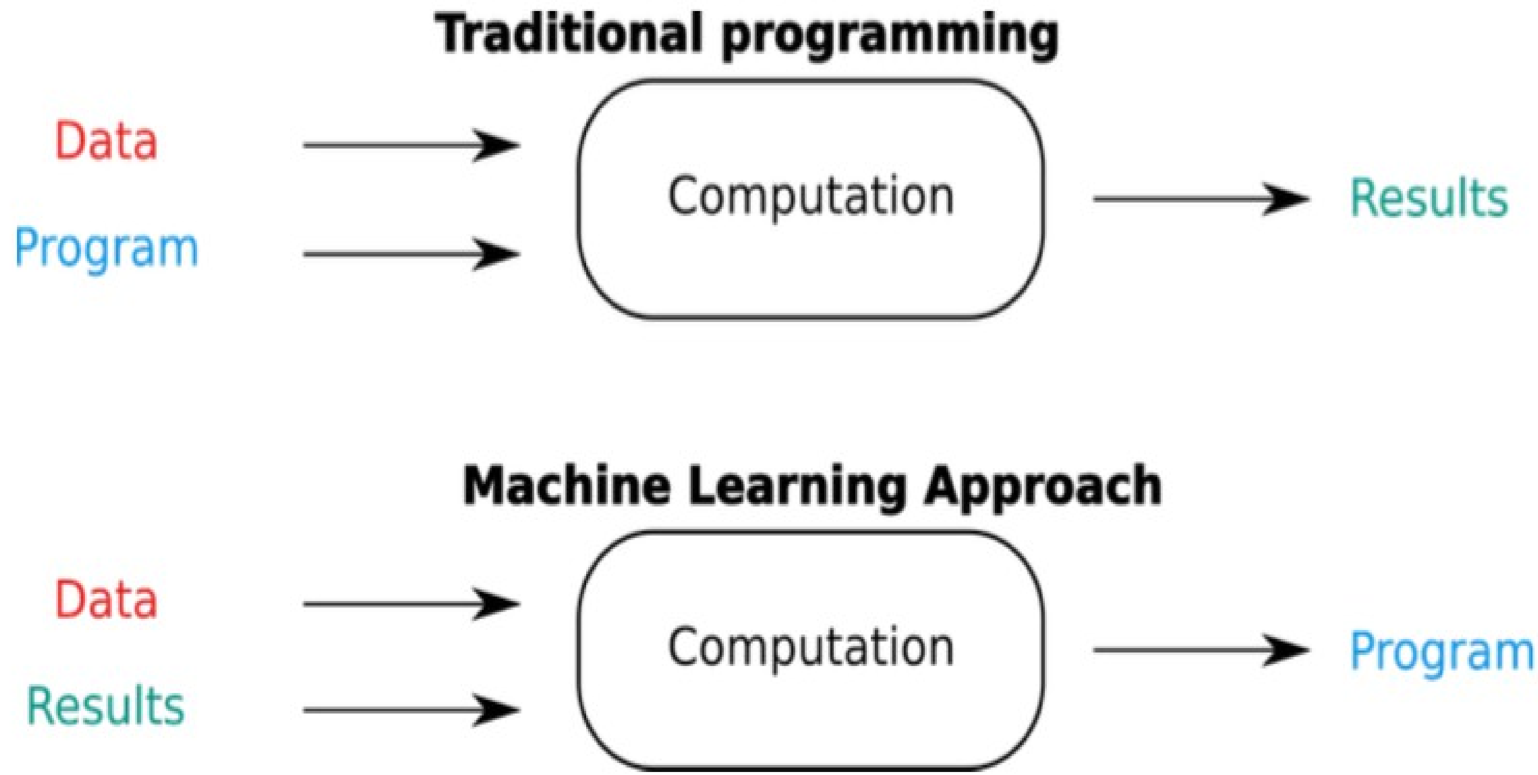
What is Machine Learning?

Machine Learning is an approach or subset of Artificial Intelligence that is based on the idea that machines can be given access to data along with the ability to learn from it.



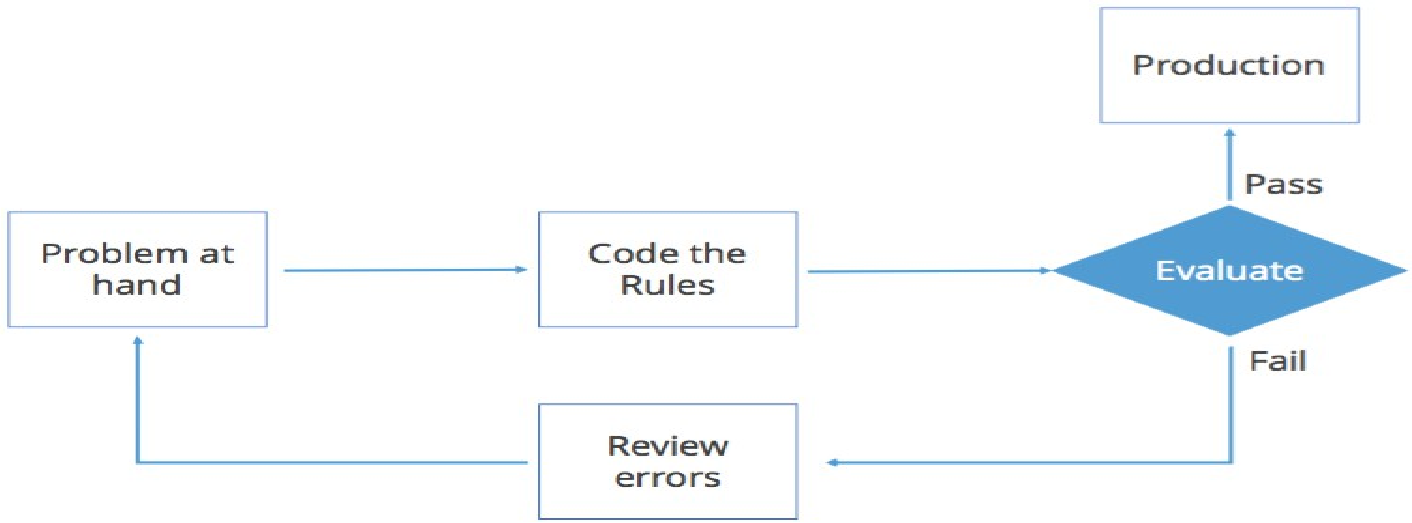
> The capability of Artificial Intelligence systems to learn by extracting patterns from data is known as Machine Learning.

Traditional Programming vs. Machine Learning Approach



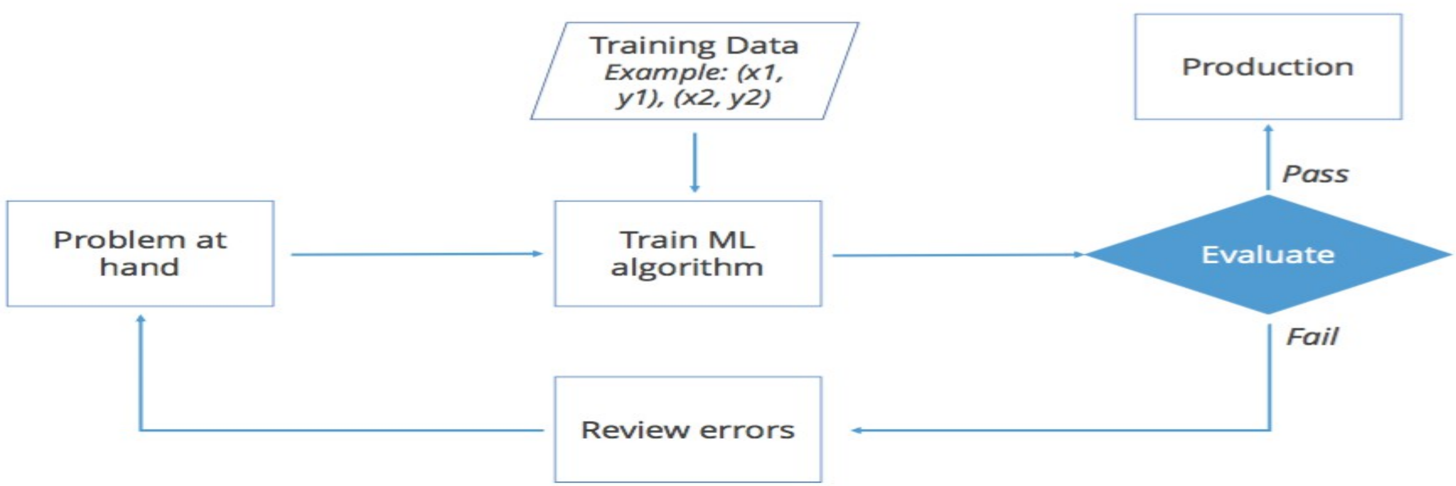
Traditional Approach

Traditional programming relies on hard-coded rules.



Machine Learning Approach

Machine Learning relies on learning patterns based on sample data.



How can machines learn?

$y = f(X)$

Learning Approaches

Supervised Learning: Learning with a labeled training set
Example: email spam detector with training set of already labeled emails

Unsupervised Learning: Discovering patterns in unlabeled data
Example: cluster similar documents based on the text content

Reinforcement Learning: learning based on feedback or reward
Example: learn to play chess by winning or losing

Inductive (Supervised) Learning

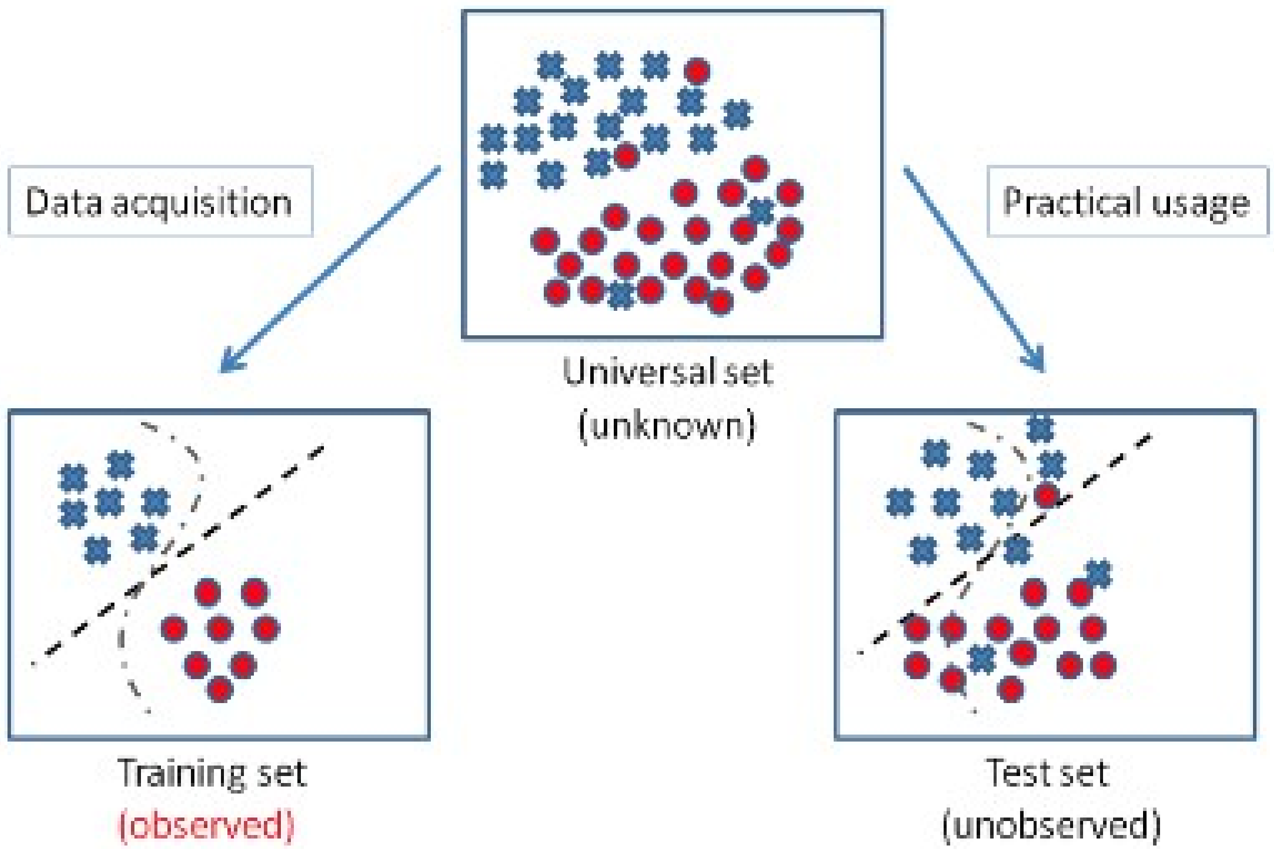
<u>Basic Problem</u>: Induce a representation of a function (a systematic relationship between inputs and outputs) from examples.

target function $f\colon X \rightarrow Y$
example $(x, f(x))$
hypothesis $g\colon X \rightarrow Y$ *such that* $g(x) = f(x)$

x = set of attribute values (***attribute-value representation***)
x = set of logical sentences (*first-order representation*)

Y = set of discrete labels (***classification***)
Y = ! (*regression*)

Learning : Training and Test Set

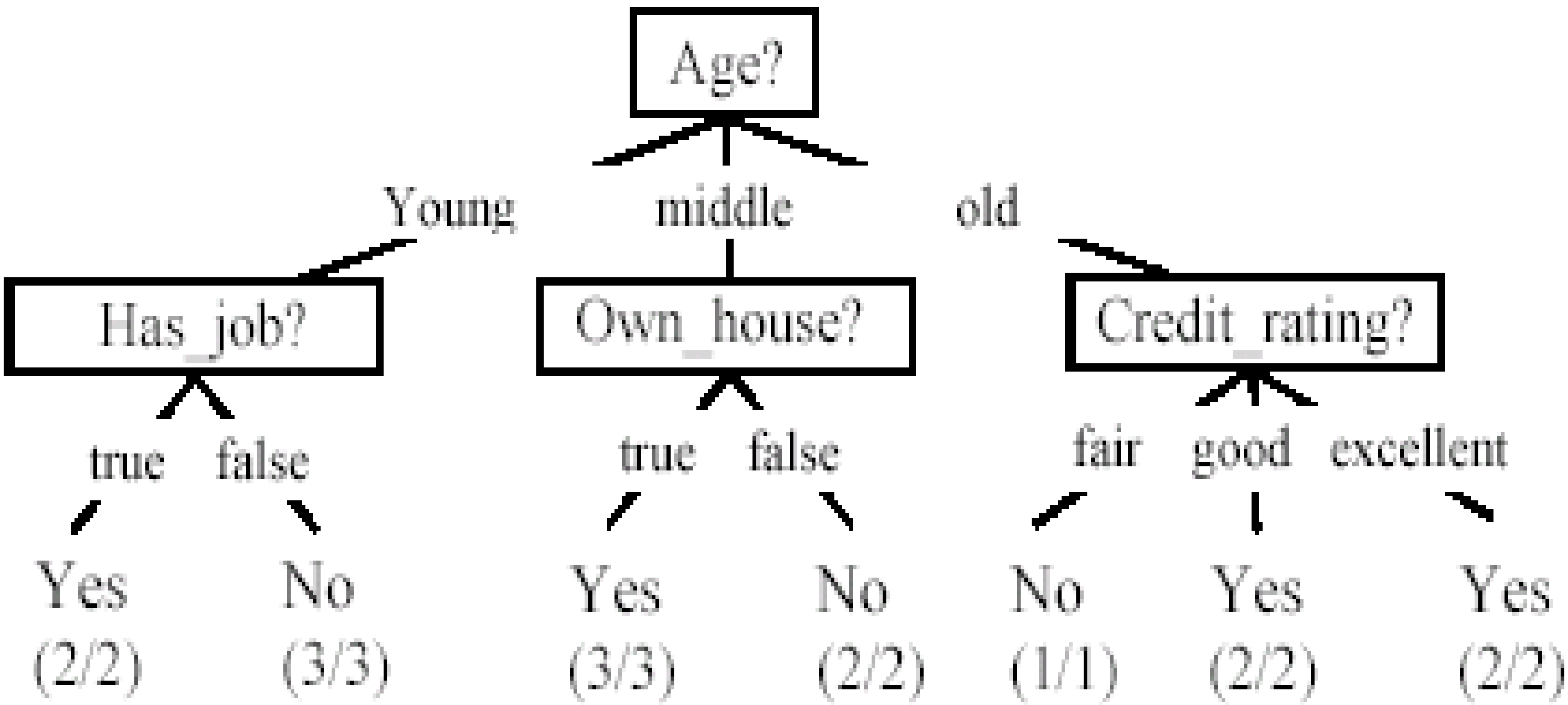


Lets look at a usecase
Loan application approval

This is a loan application data..... Lets analyze

ID	Age	Has_Job	Own_House	Credit_Rating	Class
1	young	false	false	fair	**No**
2	young	false	false	good	**No**
3	young	true	false	good	**Yes**
4	young	true	true	fair	**Yes**
5	young	false	false	fair	**No**
6	middle	false	false	fair	**No**
7	middle	false	false	good	**No**
8	middle	true	true	good	**Yes**
9	middle	false	true	excellent	**Yes**
10	middle	false	true	excellent	**Yes**
11	old	false	true	excellent	**Yes**
12	old	false	true	good	**Yes**
13	old	true	false	good	**Yes**
14	old	true	false	excellent	**Yes**
15	old	false	false	fair	**No**

A decision tree from the loan data



Hey....wait ....Is that correct?
How do we build correct and optimal tree?

How do we find out amount of information in a dataset?

Which part of data contains more information?

Entropy measure: let us get a feeling

1. The data set D has 50% positive examples ($\Pr(positive) = 0.5$) and 50% negative examples ($\Pr(negative) = 0.5$).

$$entropy(D) = -0.5 \times \log_2 0.5 - 0.5 \times \log_2 0.5 = 1$$

2. The data set D has 20% positive examples ($\Pr(positive) = 0.2$) and 80% negative examples ($\Pr(negative) = 0.8$).

$$entropy(D) = -0.2 \times \log_2 0.2 - 0.8 \times \log_2 0.8 = 0.722$$

3. The data set D has 100% positive examples ($\Pr(positive) = 1$) and no negative examples, ($\Pr(negative) = 0$).

$$entropy(D) = -1 \times \log_2 1 - 0 \times \log_2 0 = 0$$

- For classification problems, data with entropy 0 or close to 0 is rather useless. ML can't learn to distinguish between positive and negative samples using that data!

An example

$entropy(D$

$$-\left(\frac{6}{15}\times\log_2\left(\frac{6}{15}\right)-\left(\frac{9}{15}\times\log_2\left(\frac{9}{15}\right)\right)\right)$$

ID	Age	Has_Job	Own_House	Credit_Rating	Class
1	young	false	false	fair	No
2	young	false	false	excellent	No
	young	true	false	good	Yes
	young	true	true	good	Yes
	young	false	false	fair	No
	middle	false	false	fair	No
7	middle	false	false	good	No
8	middle	true	true	good	Yes
9	middle	false	true	excellent	Yes
10	middle	false	true	excellent	Yes
11	old	false	true	excellent	Yes
12	old	false	true	good	Yes
13	old	true	false	good	Yes
14	old	true	false	excellent	Yes
15	old	false	false	fair	No

$$\frac{6}{15}\times\left(-\left(\frac{6}{6}\times\log_2\left(\frac{6}{6}\right)\right)-(0\times\log_2(0))\right)+\frac{9}{15}\times\left(-\left(\frac{3}{9}\times\log_2\left(\frac{3}{9}\right)\right)-\left(\frac{6}{9}\times\log_2\left(\frac{6}{9}\right)\right)\right)$$

Age	Yes	No	entropy(Di)
young	2	3	0.971
middle	3	2	0.971
old	4	1	0.722

Calculate entropy for Age, has job and credit rating

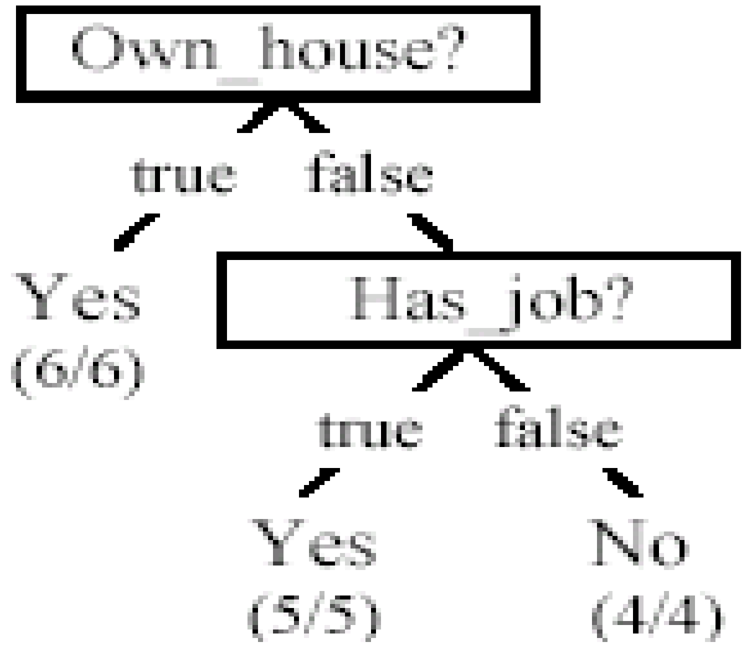
$gain(D, \text{Age}) = 0.971 - 0.888 = 0.083$

$gain(D, \text{Own\_house}) = 0.971 - 0.551 = 0.420$

$gain(D, \text{Has\_Job}) = 0.971 - 0.647 = 0.324$

$gain(D, \text{Credit\_Rating}) = 0.971 - 0.608 = 0.363$

We build the final tree

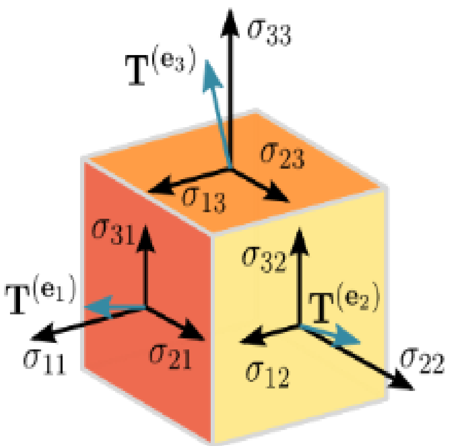


Phew that was too much Maths.Lets Automate it via AI!

And , it just takes 20 lines of code

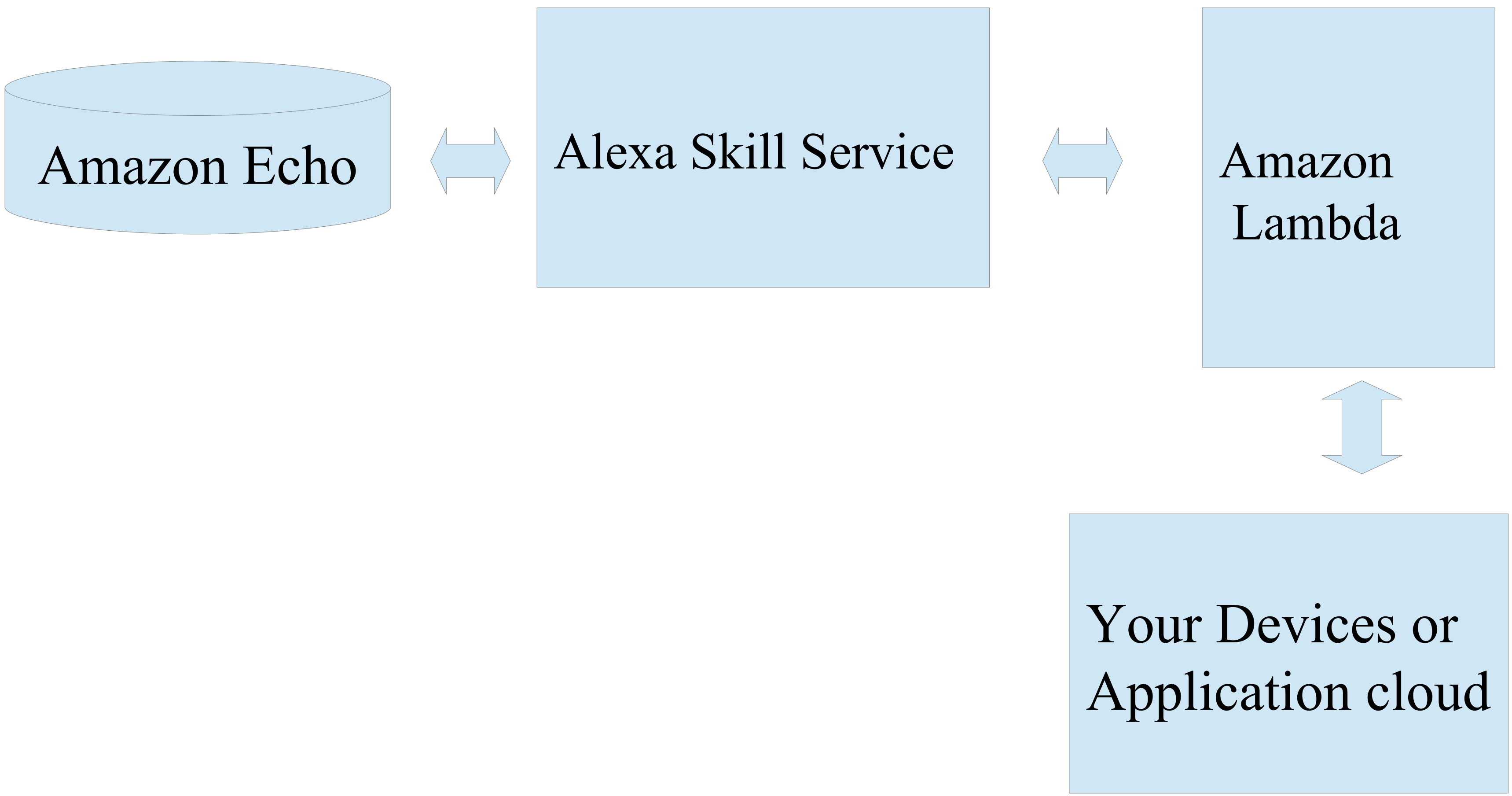
AI behind google rankings

It was November 9, 2015, the day Google publicly released TensorFlow. TensorFlow is an (now) open-source software library for machine intelligence. It is, in fact, the library that powers most of Google's technology like Gmail, Photos, Voice and RankBrain.

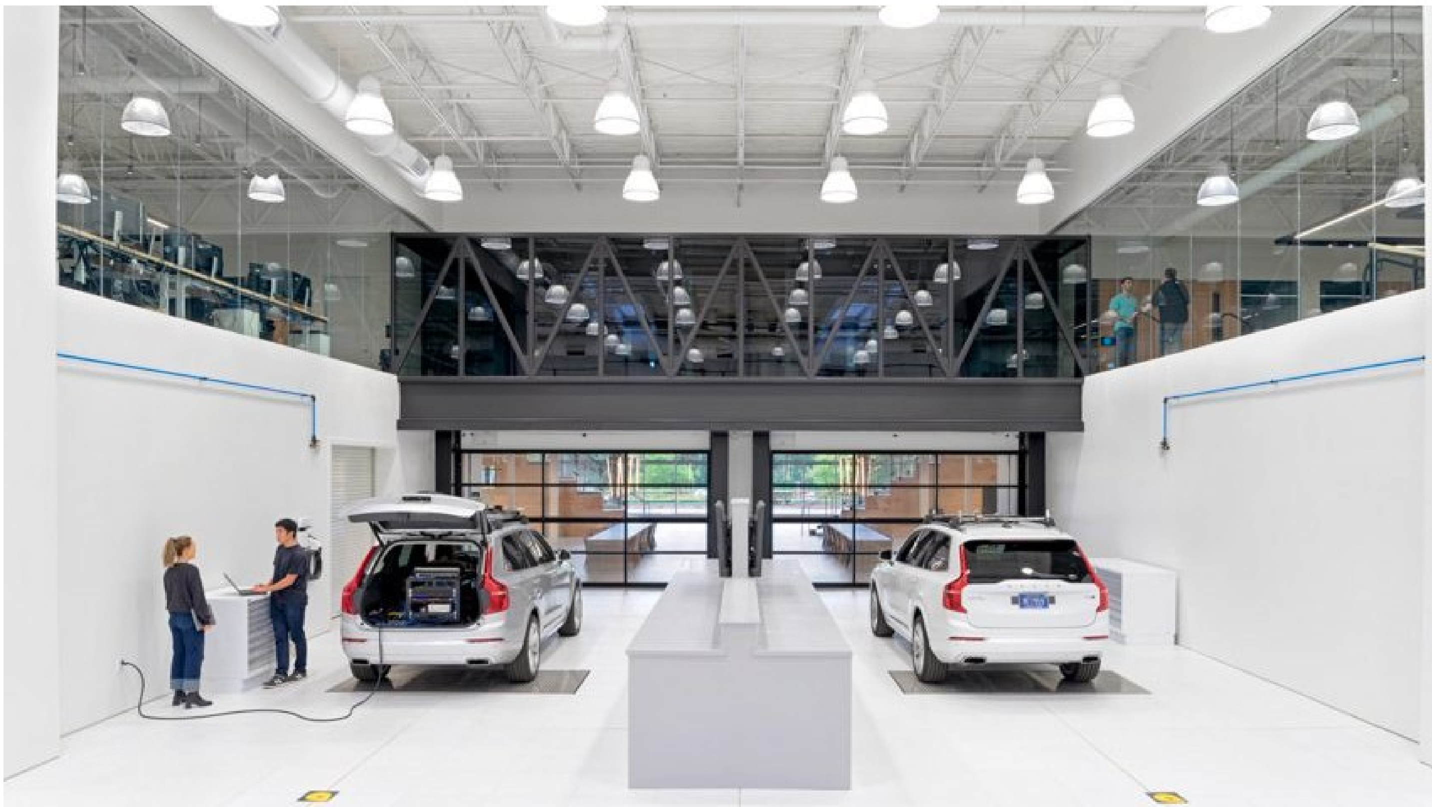


TensorFlow originally was released as an evolution of Google's internal neural network training framework "DistBelief" by the Google Brain team. On the simplest level, TensorFlow enables the large-scale and parallel manipulation of "Tensors," multi-dimensional arrays that carry vectorized data.

Human like interactions (eg Alexa)

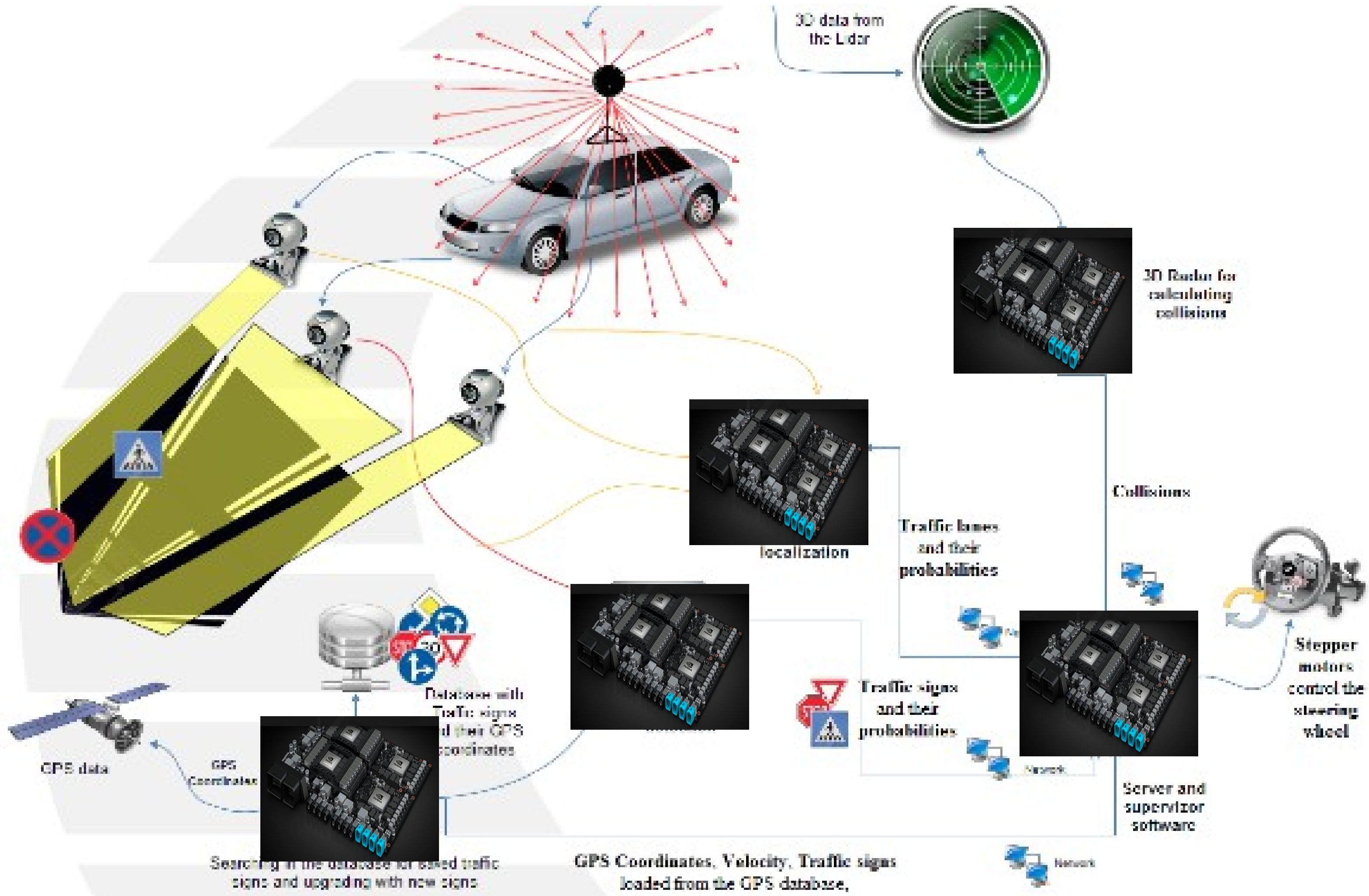


AI for Autonomous Cars



Uber builds and tests self-driving cars at engineering centre in Pittsburgh

Simplified view of Autonomous car system



Example platform: NVIDIA

DRIVE Linux Supported Features

- Kernel version 4.4.38 kernel with RT_PREEMPT patches
- Support for 64-bit user space and runtime libraries
- NvMedia APIs for HW accelerated multimedia and camera input processing
- NVIDIA CUDA 8.0 parallel computing platform
- Graphics APIs:
    - OpenGL 4.5
    - OpenGL ES 3.2
    - EGL 1.5 with EGLStream extensions
- Ubuntu 16.04 LTS target Root File System (RFS)

Read More ›

TensorRT

NVIDIA TensorRT™ is a high performance neural network inference engine for production deployment of deep learning applications. TensorRT can be used to rapidly optimize, validate and deploy a trained neural network for inference to hyperscale data centers, embedded, or automotive product platforms.

Read More ›

cuDNN

NVIDIA CUDA® Deep Neural Network library (cuDNN) is a GPU-accelerated library of primitives for deep neural networks. cuDNN provides highly tuned implementations for standard routines such as forward and backward convolution, pooling, normalization, and activation layers.

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Software Tools

Find the right tools for your needs. Our repository has the latest versions of compatible tools available for immediate download, and new updates are added on a regular basis.

Follow the links below to get started.

Tegra® System Profiler

Tegra System Profiler is a multi-core CPU sampling profiler that provides an interactive view of captured profiling data, helping improve overall application performance.

Read More ›

Tegra® Graphics Debugger

Tegra Graphics Debugger is a console-grade tool that allows you to debug and optimize your OpenGL and OpenGL ES applications, enabling you to get the latest, most advanced GPU features.

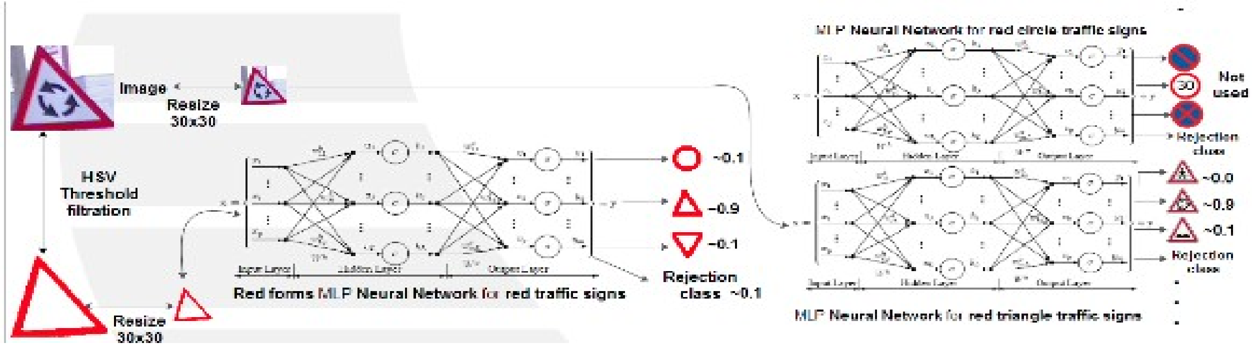
Read More ›

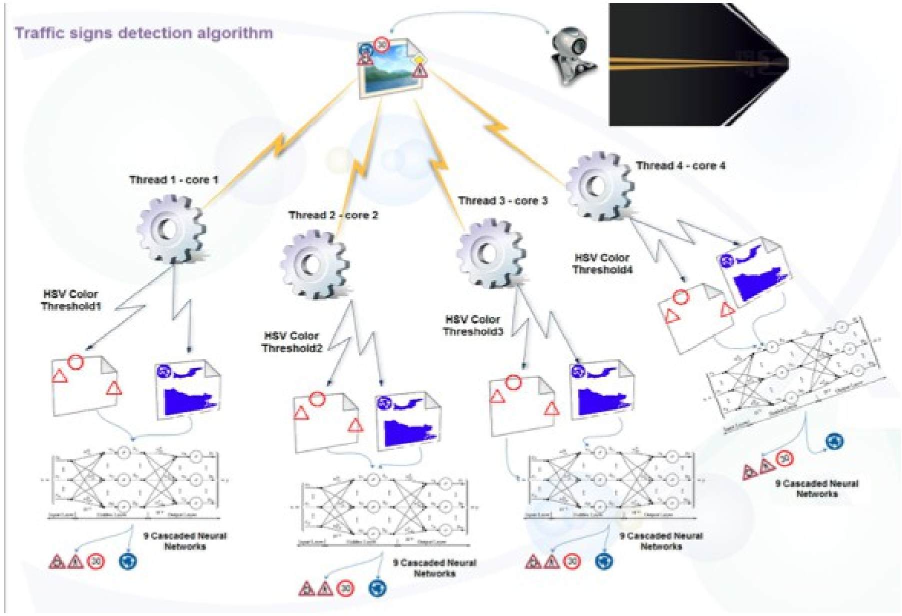
PerfKit

NVIDIA PerfKit is a comprehensive suite of performance tools to help debug and profile OpenGL and Direct3D applications.

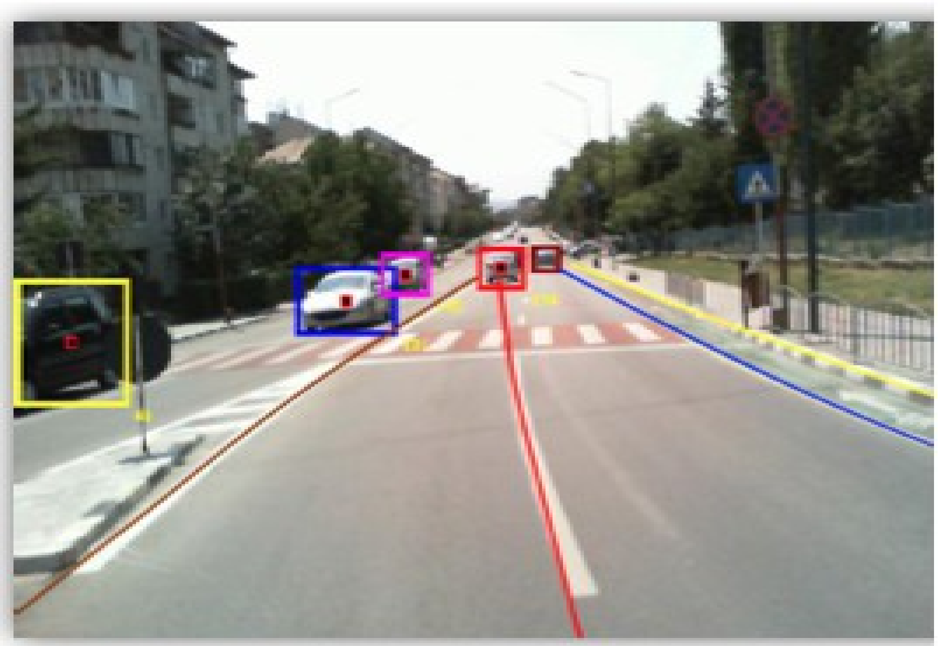
Read More ›

Traffic signs detection

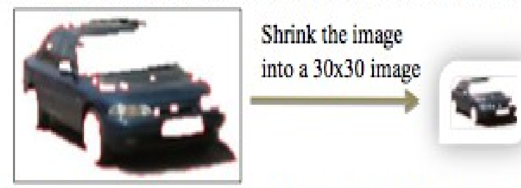




Real time vehicle detection



In order to check whether there is a car in the retrieved image from the segmentation, the algorithm uses a Multi-Layer-Perceptron Neural Network. As the resolution of the cropped image is very high, (for computers high resolution images are mostly redundant), the algorithm conceived by me will shrink the image into a small image



The Feed-forward Neural Network will be able only to classify and recognize whether in that image it is a car, so the colors are redundant.

Thank You!